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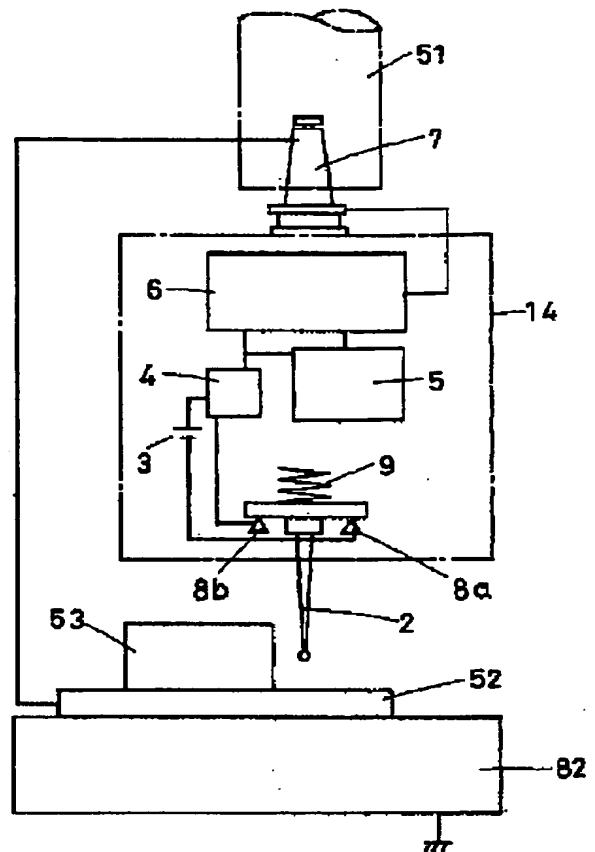
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TITLE : DEVICE FOR DETECTING WORK  
POSITION IN MACHINE TOOL



ABSTRACT : PROBLEM TO BE SOLVED: To surely transmit a detection signal to a device on the receiving side provided at a fixed position even when a work is nonconductive, in a device for detecting the position of work while a probe is brought into contact with a work held on the table or by the chuck of a machine tool.

SOLUTION: The device for detecting the position of work is provided with a housing 14 provided with a fitting part 7 held by the tool spindle of a machine tool, a detecting probe 2 energized at the stable stationary position, a detection signal generator 5 for generating a detection signal when the detecting probe is brought into contact with a work, and a transmitter for modulating the detection signal and outputting it. Further, it is provided with a circuit for generating spread-spectrum signals and a circuit for generating reverse diffusion- spectrum signals, and the output of a transmitter is outputted to the fitting part 7. A direct spreading method is preferable, as a spectrum spreading method. Thanks to the adoption of spectrum-spreading method as a modulating/ demodulating method, signals transmitted from the transmitting side device to the grounding through the main body of machine tool can be received at a practical level.

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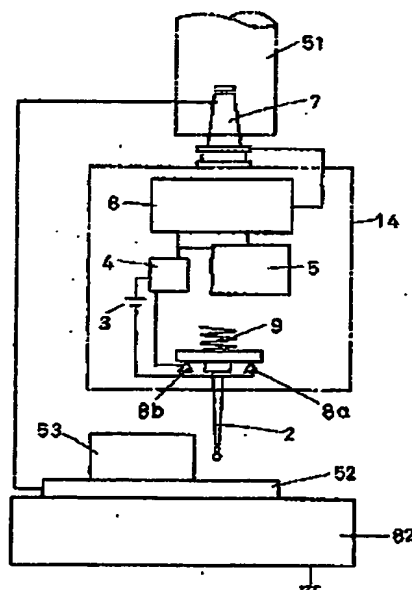
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(54) 【発明の名称】 工作機械のワーク位置検出装置

(57) 【要約】

【課題】 工作機械のテーブルやチャックに保持されたワークに接触針を当ててワークの位置を検出する装置に關し、ワークが非導電性であっても、検出信号を定位置に設置した受信側装置に確実に伝達可能な技術手段を得る。

【解決手段】 工作機械の工具端に把持される取付部7を備えたハウジング14と、安定静止位置に付勢された検出針2と、検出針とワークとが接触したときに検出信号を生成する検出信号発生器5と、この検出信号を変調して出力する送信器6とを備えたワーク位置検出装置において、スペクトル拡散信号発生回路12及びその逆拡散信号発生回路24を備え、送信器6の出力が前記取付部7に出力されることを特徴とする。スペクトル拡散方式としては、直接拡散方式が好ましい。変復調方式としてスペクトル拡散方式を採用することにより、送信側装置から工作機械本体を運ってアースに流れる信号を実用的なレベルで受信できる。



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## 【特許請求の範囲】

【請求項1】 工作機械の工具軸に把持される取付部(7)を備えたハウジング(14)と、このハウジングに遊動可能かつ安定静止位置に付勢されて装着された検出針(2)と、検出針と被検出物との接触を電気的に検出して検出信号を生成する検出信号発生器(5)と、この検出信号を変調して出力する送信器(6)とを備えた送信側装置(1)と、定位位置に設置されて前記変調された信号を受調して受信する受信側装置(21)とを備えた工作機械のワーク位置検出装置において、スペクトル拡散信号発生回路(12)及びその逆拡散信号発生回路(24)を備え、前記送信器(6)の出力は前記取付部(7)に出力され、受信側装置(21)は受信アンテナまたは工作機械本体に接続した信号線を接続する入力端(22)を備えていることを特徴とする、工作機械のワーク位置検出装置。

【請求項2】 スペクトル拡散信号発生回路(12)が前記検出信号を直接拡散方式により変調することを特徴とする、請求項1記載のワーク位置検出装置。

【請求項3】 検出針(2)の安定静止位置がハウジング(14)に対して電気的に絶縁された受座(8a, 8b)と、当該受座に向けて検出針(2)を付勢する付勢手段(9)とにより規定されており、検出針(2)とワーク(53)との接触により検出針(2)が微小遊動して検出針(2)の基端の導電部材と前記受座(8a, 8b)のいずれかが離隔することを利用して、検出信号発生器(5)が検出信号を生成することとを特徴とする、請求項1又は2記載のワーク位置検出装置。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、工作機械のテーブルやチャックに把持されたワークに接触針を当ててワークの位置を検出する位置検出装置に関するものである。

【0002】

【従来の技術】検出針とワークとの接触による検出信号を高周波出力にして工作機械自体に出力し、工作機械自体をアンテナにして無線電波を放射して、定位位置に設置した受信器により受信してワークの位置を検出する位置検出装置は、本出願人により特公平7-65883号に開示されている。図5及び図6は、この位置検出装置を示す。

【0003】図5は、検出手段及び送信器を有する送信側装置1を示している。この送信側装置1は、工作機械の工具ホルダにシャンク7により取り付けられる。このためシャンク7とワーク53とは、工作機械本体を介して電気的に導通された状態になっている。検出針2は、送信側装置1の筐体に設けた3個の受座8にバネ9で押接されて所定の安定位置に保持され、バネ9の付勢力に抗して三次元的に移動可能である。検出針2の先端がワーク53に接触すると、電池3の陰極から抵抗器62、

検出針2、ワーク53、工作機械本体及びシャンク7を経て電池3の陰極に至る回路が開成されて該回路に電流が流れる。該電流は抵抗器62の両側に電位差を生じさせ、この電位差によりトランジスタ63が導通してDTMF回路64に検出電気信号を与える。この信号はDTMF回路で設定された二重音階信号に変換されて周波数変調回路65に与えられ、発振回路66からのFM搬送波で変調された信号が増幅回路13で増幅されて出力される。この高周波出力は、検出針2に与えられ、工作機械及びシャンク7を経て流れ、工作機械全体がアンテナとなって無線電波を放出する。

【0004】図6は、受信側装置を示している。この受信側装置は、定位位置に設置されている。工作機械から放射された無線電波は、アンテナ77で受信され、高周波増幅回路71と、局部発振回路72及び周波数混合回路73からなる周波数変換回路により変換された中間周波信号を増幅する中間周波増幅回路74とにより増幅される。増幅された中間周波信号は、復調回路75及びトーンデコーダ76で最終的に検出信号として抽出され、検出針2とワーク53との接触信号がインタフェース回路31を経て数値制御装置32に与えられる。

【0005】この従来例によれば、検出針2とワーク53との接触による電気信号を該接触を利用して、工作機械自体をアンテナにして無線電波として放射するので、定位位置に設置された受信側装置は、送信側装置の移動に係わらず、検出信号を受信することができる。また、アンテナの指向性や大きさ及び取付位置の限定を受けない。

【0006】

【発明が解決しようとする課題】上記の装置では、ワーク及び工作機械本体を介して形成される閉回路を高周波電流が流れることにより検出信号が電磁波として送出される。従って、ワークが合成樹脂やセラミックス等の非導電体である場合には、上記装置でワークの位置を検出することはできない。

【0007】一方非導電性のワークの位置を検出可能な位置検出装置として、検出針を絶縁された複数の受座と当該受座に向けて検出針を付勢するバネ等を設けた位置検出装置が公知である。この種の装置では、検出針がワークと接触して微小遊動し、その遊動により検出針基端の導電部材が複数の受座のいずれかから離隔することを電気的に検出することにより、ワークと検出針の接触を検出している。

【0008】この種の装置において、送信側装置にロッドアンテナなどを設けて、当該アンテナから検出信号を送信することは当然可能であるが、そのような装置では送信側装置を取り付けた工具ホルダの移動や回転により、電波が受信側装置に伝達されない状況が起こる。送信側装置と受信側装置をケーブルで接続することは、工具ホルダの移動や回転によってケーブルが工作機械に絡

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み付くので、到底実用できない。

【0009】そこでこの発明は、ワークが非導電性のワークであっても、送信側装置から送出される検出信号を定位位置に設置した受信側装置に確実に伝送することが可能な技術手段を得ることを課題としている。

【0010】

【課題を解決するための手段】この発明のワーク位置検出装置は、工作機械の工具軸に把持される取付部7を備えたハウジング14と、このハウジングに遊動可能かつ安定静止位置に付勢されて装着された検出針2と、検出針と被検出物との接触を電気的に検出して検出信号を生成する検出信号発生器5と、この検出信号を変調して出力する送信器6とを備えた送信側装置1と、定位位置に設置されて前記変調された信号を復調して受信する受信側装置21とを備えた工作機械のワーク位置検出装置において、スペクトル拡散信号発生回路12及びその逆拡散信号発生回路24を備え、前記送信器6の出力は前記取付部7に出力され、受信側装置21は受信アンテナまたは工作機械本体に接続した信号線を接続する入力端22を備えていることを特徴とするものである。

【0011】本願請求項2記載の発明は、請求項1記載のワーク位置検出装置において、スペクトル拡散信号発生回路12が前記検出信号を直接拡散方式により変調することを特徴とするものである。

【0012】本願請求項3記載の発明は、請求項1又は請求項2記載のワーク位置検出装置において、検出針2の安定静止位置がハウジング14に対して電気的に絶縁された受座8と、当該受座に向けて検出針2を付勢する付勢手段9とにより規定されており、検出針2とワーク53との接触により検出針2が微小遊動して検出針2の基端の導電部材と前記受座8のいずれかが離隔することを利用して検出信号発生器5が検出信号を生成することを特徴とするものである。

【0013】変調及び復調に直接拡散方式を用いた場合には、送信側装置の検出信号は、変調回路11により変調された後、並列信号を掛け合わされて高周波信号になる。また、受信側装置においては、高周波入力は、逆拡散信号を掛け合わされた後、復調された検出信号を取り出す。拡散信号と逆拡散信号とは検出信号のビット区間と同じ周期を持つ同一のPN系列符号の信号である。

【0014】

【作用】工作機械は工場の床面に設置され、実習上接地（アース）された状態となっている。静電気の帯電による電撃を防ぐために、工作機械を積極的に接地することも普通に行われている。従って送信側装置で検出した検出信号を高周波変調して、送信側装置を取り付けた工具ホルダに出力してやれば、その電流は工作機械本体を流れてアースに流れる。本願発明の発明者は、送信側装置から工作機械本体を流れてアースに流れる電流を受信側装置で受信させることを種々試みたが、実用可能な装置

を得ることができなかった。

【0015】工作機械には電動機や各種の電気制御機器が装着されており、それらの機器の動作によって生ずる雑音信号が工作機械本体を流れており、また工作機械本体は電気良導体であるから、送信側装置から出力された信号の信号レベルも極めて低いものになってしまう。そのため送信側装置から送出される信号のレベルをよほど高くしないと、位置検出信号と雑音信号との判別が不可能であった。

【0016】この発明は、上記のような失敗の経緯を経てなされたもので、送受信器の変復調方式として、スペクトル拡散方式を採用することにより、送信側装置から工作機械本体を流れてアースに流れる出力信号が実用的なレベルで受信側装置で受信されることを見出すことによってなされたものである。

【0017】本発明の位置検出装置においては、送信側装置1は工作機械の工具ホルダ51に取り付けられ、受信側装置21は工作機械本体に接続した定位位置に設置される。送信側装置の検出針2の先端がワーク53に接触すると、電池3の陽極から陰極に至る回路が開成または閉成され、検出信号発生器5が検出信号を生成し、変調回路11により検出信号を一次変調し、この変調された検出信号をさらに拡散変調方式により二次変調して得た高周波を送信側装置のハウジング14（シャック7）を介して工具ホルダ51に出力するという一連の動作が行われる。

【0018】受信側装置においては、無線又は工作機械に接続したケーブルを介する有線接続により、入力端22に上記手段で変調された高周波を入力し、逆並列復調されたあと復調回路27により送信側装置の一次変調方式に対応する復調方式で復調して検出信号を取り出す。

【0019】

【発明の実施の形態】図1は、本発明の位置検出装置の送信側装置1の実施例を示す。送信側装置1は、検出針2、電池3、スイッチ回路4、検出信号発生器5及び送信器6を有する。送信側装置1全体は、ハウジング14に設けたシャック7により工作機械の工具ホルダ51に取り付けられている。

【0020】検出針2の基端は送信側装置のハウジング14に電気的に絶縁して設けた三箇所の受座8a、8b、8c（8cは図示されていない）にバネ9により押接されて所定の静止安定位置に保持され、バネ9の付勢力に抗して三次元的に遊動可能である。ハウジング14との間または検出針の基端との間に電気絶縁体を介して装着されている。電池3の電極は一方が受座の一方8aに、他方がスイッチ回路4を経て他方の受座8bに接続されている。

【0021】検出針2の先端がワーク53に接触すると、検出針2が微小遊動してその基部をバネ9の付勢力に抗して遊動させる。これにより受座の一方が検出針2

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の若部から離れ、電池3の両極間の導通が遮断される。これにより、スイッチ回路4をON状態にして送信器6及び検出信号発生器5を作動させる。

【0022】図2は、検出信号発生器5の実施例を示している。この検出信号発生器5は、電池電圧から分圧回路により一定電圧値の検出信号を生成する。この電圧値は、送信器6の設定により決定される。このような検出信号ではビット区間が定まらないが、適宜設定する。

【0023】図3は、送信器の実施例を示すブロック図である。この送信器6は、検出信号発生器5の検出信号を、変調回路11でBPSK変調した後、拡散信号発生回路12により生じるPN系列符号の繰り返しである拡散信号を掛け合わせ、増幅回路13で増幅して高周波出力とするものである。

【0024】送信器6からの高周波出力は、シャック7に与えられ、工具ホルダ51及び工作機械本体を経てアースに流れる。

【0025】図4は受信側装置を示すブロック図である。この受信側装置21は入力端22、同期追跡回路23、逆拡散信号発生回路24、第一帯域フィルタ25、第二帯域フィルタ26、復調回路27及び増幅回路28を有する。入力端22は信号線81で工作機械本体82に接続されている。信号線81を介して入力端22に入力した高周波信号は、第一帯域フィルタ25により不要な周波数帯を除去して高周波入力として取り出される。該高周波入力は、同期追跡回路23により逆拡散用のPN系列符号との相関値のピーク信号を検出して、そのピーク信号により決まるタイミングで、逆拡散信号発生回路24により生成された逆拡散信号が掛け合わされる。この逆拡散された高周波入力は、第二帯域フィルタ26を通過した後、復調回路27によりBPSK復調されて検出信号が復調される。この検出信号は、増幅回路28により必要なレベルに増幅された後、インタフェース回路31を経て数値制御装置32に与えられる。

【0026】数値制御装置32は、工具ホルダ51とテーブル52の位置を常に監視してこれを制御している。前記検出信号が与えられたときの工具ホルダ51とテーブル52との位置信号から、ワーク53の位置を正確に知ることができる。

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\*【0027】なお、検出信号発生器5は、要求される検出精度により決まる一定時間の周期の符号を発生する回路構成とすることも可能である。周期が長い場合には、変復調方式にQPSK方式などの多値位相変調方式を採用して送信データ容量を増やす構成を採用することができる。位置検出装置からの信号が他の装置等からの信号と時間的に重ならないときには、上記構成の位置検出装置においては、受信側装置の回路構成を変更したり、受信側装置を増設したりすることなく、多数の機械の動作を監視することが可能である。

【0028】図の実施例の説明においては、受信側装置の入力端をケーブルで送信側装置が装着された工作機械本体に接続する例を示したが、入力端にアンテナを接続し、工作機械本体から放出される電波を受信することにより、位置検出信号の受信を行うこともできる。

【図面の簡単な説明】

【図1】位置検出装置の送信側装置を示すブロック図

【図2】送信側装置の検出信号発生器の実施例を示す回路図

【図3】送信側装置の送信器を示すブロック図

【図4】位置検出装置の受信側装置を示すブロック図

【図5】従来例の位置検出装置の送信側装置を示すブロック図

【図6】従来例の位置検出装置の受信側装置を示すブロック図

【符号の説明】

1 送信側装置

2 検出針

3 電池

5 検出信号発生器

6 送信器

8a, 8b 受座

9 バネ

12 スペクトル拡散信号発生回路

14 ハウジング

21 受信側装置

22 入力端

24 逆拡散信号発生回路

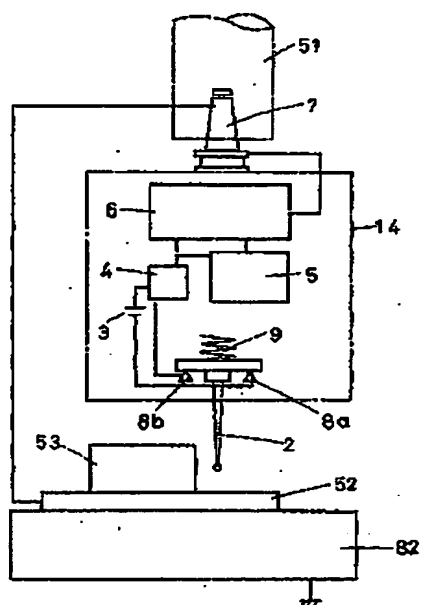
【図2】



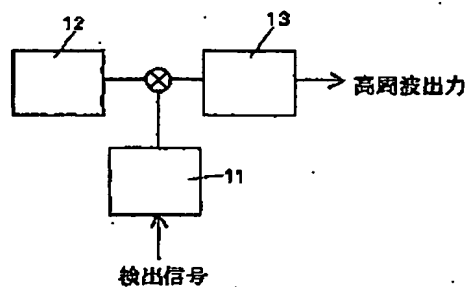
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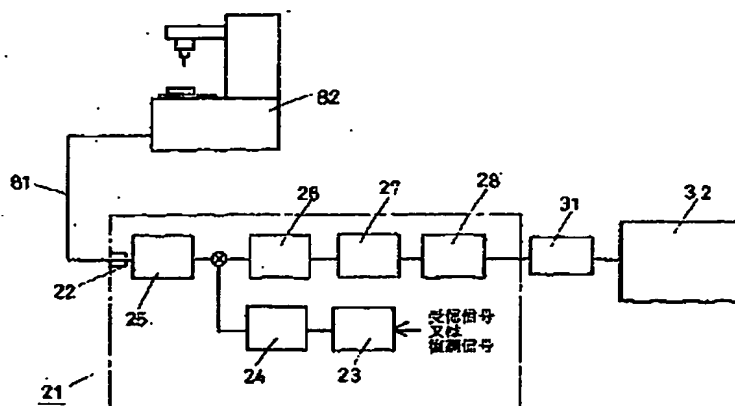
【図1】



【図3】



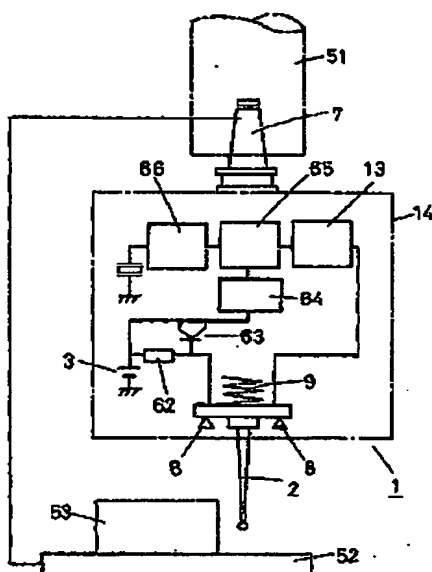
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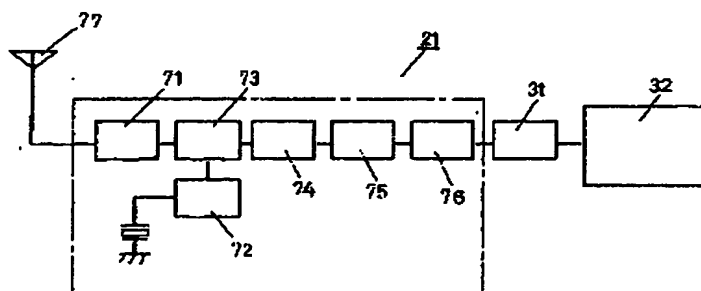
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【図5】



【図6】



## TECHNICAL FIELD

[Field of the Invention] This invention relates to the location detection equipment which applies a contact needle to the work piece held at the table and chuck of a machine tool, and detects the location of a work piece.

## PRIOR ART

[Description of the Prior Art] The detecting signal by contact to a detection needle and a work piece is made a RF output, it outputs to the machine tool itself, the machine tool itself is used as an antenna, a wireless electric wave is emitted, and the location detection equipment which receives with the receiver installed in an orientation and detects the location of a work piece is indicated by these people at JP, 7-65883, B. Drawing 5 and drawing 6 show this location detection equipment.

[0003] Drawing 5 shows the transmitting-side equipment 1 which has a detection means and a transmitter. This transmitting-side equipment 1 is attached in the tool holder of a machine tool by the shank 7. For this reason, the shank 7 and the work piece 53 will be electrically flowed through the body of a machine tool. Three strikes 8 prepared in the case of transmitting-side equipment 1 contact the detection needle 2 by pressing with a spring 9, it is held in a predetermined stabilization location, resists the energization force of a spring 9, and is movable in three dimensions. If the tip of the detection needle 2 contacts a work piece 53, the circuit which reaches the cathode of a cell 3 through a resistor 62, the detection needle 2, a work piece 53, the body of a machine tool, and a shank 7 will be closed from the anode plate of a cell 3, and a current will flow in this circuit. This current makes the both sides of a resistor 62 produce the potential difference, and a transistor 63 flows through it according to this potential difference, and it gives a detection electrical signal to the DTMF circuit 64. This signal is changed into the duplex scale signal set up in the DTMF circuit, is given to the frequency modulation circuit 65, and the signal modulated by FM subcarrier from an oscillator circuit 66 is amplified in an amplifying circuit 13, and it is outputted. The detection needle 2 is given, it flows through a machine tool and a shank 7, the whole machine tool serves as an antenna, and this RF output emits a wireless electric wave.

[0004] Drawing 6 shows receiving-side equipment. This receiving-side equipment is installed in the orientation. It is received by the antenna 77 and the wireless electric wave emitted from the machine tool is amplified by the RF amplifying circuit 71 and the intermediate frequency amplifying circuit 74 which amplifies the intermediate frequency signal changed by the frequency changing circuit which consists of a local oscillation circuit 72 and a frequency-mixing circuit 73. Finally the amplified intermediate frequency signal is extracted as a detecting signal by the demodulator circuit 75 and the tone decoder 76, and the contact signal of the detection needle 2 and a work piece 53 is given to numerical-control equipment 32 through an interface circuitry 31.

[0005] Since according to this conventional example the machine tool itself is used as an antenna and the electrical signal by contact to the detection needle 2 and a work piece 53 is emitted as a wireless electric wave using this contact, the receiving-side equipment installed in the orientation can receive a detecting signal irrespective of migration of transmitting-side equipment. Moreover, limitation of the directivity, the magnitude, and the attaching position of an antenna is not received.

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] With above equipment, when the high frequency current flows the closed circuit formed through a work piece and the body of a machine tool, a detecting signal is sent out as an electromagnetic wave. Therefore, when work pieces are non-conductors, such as synthetic resin and ceramics, the above-mentioned equipment cannot detect the location of a work piece.

[0007] The location detection equipment which prepared the spring which energizes a detection needle towards two or more strikes with which it considered as the location detection equipment which can, on the other hand, detect the location of a non-conductive work piece, and the detection needle was insulated, and the strike concerned is well-known. With this kind of equipment, contact of a work piece and a detection needle is detected by a detection needle's contacting a work piece, carrying out very small idle movement, and detecting electrically that the conductive member of a detection needle end face is isolated from either of two or more strikes by that ranging behavior.

[0008] In this kind of equipment, although it is naturally possible to form a lot antenna etc. in transmitting-side equipment, and to transmit a detecting signal from the antenna concerned, with such equipment, the situation that an electric wave is not transmitted to receiving-side equipment happens by migration and rotation of the tool holder which attached transmitting-side equipment. Since a cable gets twisted around a machine tool by migration and rotation of a tool holder, it is unusable to connect transmitting-side equipment and receiving-side equipment by the cable at all.

[0009] Then, this invention makes it the technical problem to acquire the technical means which can be certainly

RF  
output

se whole  
w/c as  
transmitter



transmitted to the receiving-side equipment which installed the detecting signal sent out from transmitting-side equipment in the orientation, even if a work piece is a non-conductive work piece.

## MEANS

[Means for Solving the Problem] The housing 14 equipped with the attachment section 7 in which the work-piece location detection equipment of this invention is grasped by the tool shaft of a machine tool, That idle movement in this housing is possible, and the detection needle 2 with which were energized by the stabilization static position and it was equipped, The detection signal generator 5 which detects contact to a detection needle and a detected material electrically, and generates a detecting signal, In the work-piece location detection equipment of the machine tool equipped with transmitting-side equipment 1 equipped with the transmitter 6 which modulates and outputs this detecting signal, and the receiving-side equipment 21 which is installed in an orientation, restores to said modulated signal, and is received It has the spread-spectrum signal generating circuit 12 and its back-diffusion-of-electrons signal generating circuit 24, the output of said transmitter 6 is outputted to said attachment section 7, and it is characterized by equipping receiving-side equipment 21 with the input edge 22 which connects the signal line linked to a receiving antenna or the body of a machine tool.

[0011] Invention of this application claim 2 publication is characterized by the spread-spectrum signal generating circuit 12 modulating said detecting signal with a direct diffusion method in work-piece location detection equipment according to claim 1.

[0012] Invention of this application claim 3 publication is set to work-piece location detection equipment according to claim 1 or 2. The strike 8 with which the stabilization static position of the detection needle 2 was electrically insulated to housing 14, It is prescribed by energization means 9 to energize the detection needle 2 towards the strike concerned. It is characterized by the detection signal generator 5 generating a detecting signal using the detection needle 2 carrying out very small idle movement by contact to the detection needle 2 and a work piece 53, and the conductive member of the end face of the detection needle 2 and either of said strikes 8 being isolated.

[0013] When a direct diffusion method is used for a modulation and a recovery, after a modulation circuit 11 becomes irregular, the detecting signal of transmitting-side equipment has a diffusion signal multiplied, and turns into a RF signal. Moreover, in receiving-side equipment, a RF input takes out the detecting signal to which it restored, after having a back-diffusion-of-electrons signal multiplied. A diffusion signal and a back-diffusion-of-electrons signal are signals with the same period as the bit section of a detecting signal of the same PN sequence sign.

## OPERATION

[Function] A machine tool is installed in the floor line of works, and is in the condition that touch-down (ground) on parenchyma was carried out. In order to prevent the electric shock by electrification of static electricity, grounding a machine tool positively is also performed ordinarily. Therefore, the RF modulation of the detecting signal detected with transmitting-side equipment is carried out, and if it outputs to the tool holder which attached transmitting-side equipment, the current will flow to a ground through the body of a machine tool. Although the artificer of the invention in this application tried various things made for receiving-side equipment to receive the current which flows from transmitting-side equipment to a ground through the body of a machine tool, he was not able to get usable equipment.

[0015] The machine tool is equipped with a motor or various kinds of electric control devices, the noise signal produced by actuation of those devices is flowing the body of a machine tool, and since the body of a machine tool is an electric good conductor, it will become what also has the very low signal level of the signal outputted from transmitting-side equipment. Therefore, when level of the signal sent out from transmitting-side equipment was not made very high, distinction with a location detecting signal and a noise signal was impossible.

[0016] This invention was made through the circumstances of the above failure, and as a strange recovery method of a transceiver machine, by adopting spectrum spread system, when the output signal which flows from transmitting-side equipment to a ground through the body of a machine tool finds out being received with receiving-side equipment with practical level, it is made.

[0017] In the location detection equipment of this invention, transmitting-side equipment 1 is attached in the tool holder 51 of a machine tool, and receiving-side equipment 21 is installed in the orientation contiguous to the body of a machine tool. Or it is closed. the circuit from the anode plate of a cell 3 to [ if the tip of the detection needle 2 of transmitting-side equipment contacts a work piece 53 ] cathode -- Kaisei -- The detection signal generator 5 generates a detecting signal, and modulates a detecting signal primarily by the modulation circuit 11. A series of actuation of outputting the high frequency which became irregular secondarily by the diffusion modulation technique further, and obtained this modulated detecting signal to the tool holder 51 through the housing 14 (shank 7) of transmitting-side equipment is performed.

[0018] In receiving-side equipment, the RF modulated with the above-mentioned means is inputted into the input edge 22, after a back-diffusion-of-electrons recovery is carried out by the cable connection through the cable linked

RF  
modulation

Spectrum  
spread  
system

to wireless or a machine tool, it gets over by the demodulator circuit 27 by the recovery method corresponding to the primary modulation technique of transmitting-side equipment, and a detecting signal is taken out by it.

[0019]

[Embodiment of the Invention] Drawing 1 shows the example of the transmitting-side equipment 1 of the location detection equipment of this invention. Transmitting-side equipment 1 has the detection needle 2, a cell 3, a switching circuit 4, the detection signal generator 5, and a transmitter 6. The transmitting-side equipment 1 whole is attached in the tool holder 51 of a machine tool by the shank 7 prepared in housing 14.

[0020] Three strikes 8a, 8b, and 8c (not shown [ 8c ]) which insulated in the housing 14 of transmitting-side equipment electrically, and were prepared in it contact the base of the detection needle 2 by pressing with a spring 9, it can be held in a predetermined quiescence stability location, can resist the energization force of a spring 9, and can move idly in three dimensions. It is equipped with the spring 9 through the electric insulator between housing or between the bases of a detection needle. As for the electrode of a cell 3, another side is connected to one side 8a of a strike for one side through the switching circuit 4 at strike 8b of another side.

[0021] If the tip of the detection needle 2 contacts a work piece 53, the detection needle 2 will carry out very small idle movement, and the ranging behavior of the base will be resisted and carried out to the energization force of a spring 9. One side of a strike separates from the base of the detection needle 2 by this, and the flow between the two poles of a cell 3 is intercepted. Thereby, a switching circuit 4 is changed into ON condition, and a transmitter 6 and the detection signal generator 5 are operated.

[0022] Drawing 2 shows the example of the detection signal generator 5. This detection signal generator 5 generates the detecting signal of a fixed electrical-potential-difference value by the partial pressure circuit from cell voltage. This electrical-potential-difference value is determined by setup of a transmitter 6. Although the bit section does not become settled in such a detecting signal, it sets up suitably.

[0023] Drawing 3 is the block diagram showing the example of a transmitter. After this transmitter 6 carries out the BPSK modulation of the detecting signal of the detection signal generator 5 in a modulation circuit 11, it multiplies the diffusion signal which is the repeat of PN sequence sign produced by the diffusion signal generating circuit 12, amplifies it in an amplifying circuit 13, and is considered as a RF output.

[0024] The RF output from a transmitter 6 is given to a shank 7, and flows to a ground through the tool holder 51 and the body of a machine tool.

[0025] Drawing 4 is the block diagram showing receiving-side equipment. This receiving-side equipment 21 has the input edge 22, the synchronous trace circuit 23, the back-diffusion-of-electrons signal generating circuit 24, the first band-pass filter 25, the second band-pass filter 26, a demodulator circuit 27, and an amplifying circuit 28. The input edge 22 is connected to the body 82 of a machine tool with the signal line 81. The RF signal inputted into the input edge 22 through the signal line 81 removes an unnecessary frequency band with the first band-pass filter 25, and is taken out as a RF input. This RF input detects the peak signal of a correlation value with PN sequence sign for the back diffusion of electrons by the synchronous trace circuit 23, it is the timing decided with the peak signal, and the back-diffusion-of-electrons signal generated by the back-diffusion-of-electrons signal generating circuit 24 is multiplied. After this RF input by which the back diffusion of electrons was carried out passes the second band-pass filter 26, a BPSK recovery is carried out by the demodulator circuit 27, and a detecting signal restores to it. After this detecting signal is amplified by required level by the amplifying circuit 28, it is given to numerical-control equipment 32 through an interface circuitry 31.

[0026] Since numerical-control equipment 32 always supervises the location of the tool holder 51 and a table 52 and is controlling this, it can know the location of a work piece 53 correctly from the position signal of the tool holder 51 when said detecting signal is given, and a table 52.

[0027] In addition, the detection signal generator 5 can also be considered as the circuitry which generates the sign of the period of fixed time amount decided by detection precision demanded. When a period is long, the configuration which adopts multiple-value phase modulation systems, such as a QPSK method, as a strange recovery method, and increases transmit data capacity can be adopted. When the signal from location detection equipment does not happen to other signals and time amount targets one after another from equipment etc., it is possible to supervise actuation of many machines, without changing the circuitry of receiving-side equipment or extending receiving-side equipment in the location detection equipment of the above-mentioned configuration.

[0028] In explanation of the example of drawing, although the example linked to the body of a machine tool with which transmitting-side equipment was equipped with the input edge of receiving-side equipment by the cable was shown, a location detecting signal is also receivable by connecting an antenna to an input edge and receiving the electric wave emitted from the body of a machine tool.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the transmitting-side equipment of location detection equipment

[Drawing 2] The circuit diagram showing the example of the detection signal generator of transmitting-side equipment

electromagnetic wave. Therefore, when work pieces are non-conductors, such as synthetic resin and ceramics, the above-mentioned equipment cannot detect the location of a work piece.

[0007] The location detection equipment which prepared the spring which energizes a detection needle towards two or more strikes with which it considered as the location detection equipment which can, on the other hand, detect the location of a non-conductive work piece, and the detection needle was insulated, and the strike concerned is well-known. With this kind of equipment, contact of a work piece and a detection needle is detected by a detection needle's contacting a work piece, carrying out very small idle movement, and detecting electrically that the conductive member of a detection needle end face is isolated from either of two or more strikes by that ranging behavior.

[0008] In this kind of equipment, although it is naturally possible to form a lot antenna etc. in transmitting-side equipment, and to transmit a detecting signal from the antenna concerned, with such equipment, the situation that an electric wave is not transmitted to receiving-side equipment happens by migration and rotation of the tool holder which attached transmitting-side equipment. Since a cable gets twisted around a machine tool by migration and rotation of a tool holder, it is unusable to connect transmitting-side equipment and receiving-side equipment by the cable at all.

[0009] Then, this invention makes it the technical problem to acquire the technical means which can be certainly transmitted to the receiving-side equipment which installed the detecting signal sent out from transmitting-side equipment in the orientation, even if a work piece is a non-conductive work piece.

[0010]

[Means for Solving the Problem] The housing 14 equipped with the attachment section 7 in which the work-piece location detection equipment of this invention is grasped by the tool shaft of a machine tool. That idle movement in this housing is possible, and the detection needle 2 with which were energized by the stabilization static position and it was equipped, The detection signal generator 5 which detects contact to a detection needle and a detected material electrically, and generates a detecting signal, In the work-piece location detection equipment of the machine tool equipped with transmitting-side equipment 1 equipped with the transmitter 6 which modulates and outputs this detecting signal, and the receiving-side equipment 21 which is installed in an orientation, restores to said modulated signal, and is received It has the spread-spectrum signal generating circuit 12 and its back-diffusion-of-electrons signal generating circuit 24, the output of said transmitter 6 is outputted to said attachment section 7, and it is characterized by equipping receiving-side equipment 21 with the input edge 22 which connects the signal line linked to a receiving antenna or the body of a machine tool.

[0011] Invention of this application claim 2 publication is characterized by the spread-spectrum signal generating circuit 12 modulating said detecting signal with a direct diffusion method in work-piece location detection equipment according to claim 1.

[0012] Invention of this application claim 3 publication is set to work-piece location detection equipment according to claim 1 or 2. The strike 8 with which the stabilization static position of the detection needle 2 was electrically insulated to housing 14, It is prescribed by energization means 9 to energize the detection needle 2 towards the strike concerned. It is characterized by the detection signal generator 5 generating a detecting signal using the detection needle 2 carrying out very small idle movement by contact to the detection needle 2 and a work piece 53, and the conductive member of the end face of the detection needle 2 and either of said strikes 8 being isolated.

[0013] When a direct diffusion method is used for a modulation and a recovery, after a modulation circuit 11 becomes irregular, the detecting signal of transmitting-side equipment has a diffusion signal multiplied, and turns into a RF signal. Moreover, in receiving-side equipment, a RF input takes out the detecting signal to which it restored, after having a back-diffusion-of-electrons signal multiplied. A diffusion signal and a back-diffusion-of-electrons signal are signals with the same period as the bit section of a detecting signal of the same PN sequence sign.

[0014]

[Function] A machine tool is installed in the floor line of works, and is in the condition that touch-down (ground) on parenchyma was carried out. In order to prevent the electric shock by electrification of static electricity, grounding a machine tool positively is also performed ordinarily. Therefore, the RF modulation of the detecting signal detected with transmitting-side equipment is carried out, and if it outputs to the tool holder which attached transmitting-side equipment, the current will flow to a ground through the body of a machine tool. Although the artificer of the invention in this application tried various things made for receiving-side equipment to receive the current which flows from transmitting-side equipment to a ground through the body of a machine tool, he was not able to get usable equipment.

[0015] The machine tool is equipped with a motor or various kinds of electric control devices, the noise signal produced by actuation of those devices is flowing the body of a machine tool, and since the body of a machine tool is an electric good conductor, it will become what also has the very low signal level of the signal outputted from transmitting-side equipment. Therefore, when level of the signal sent out from transmitting-side equipment was not made very high, distinction with a location detecting signal and a noise signal was impossible.

[0016] This invention was made through the circumstances of the above failure, and as a strange recovery method of a transceiver machine, by adopting spectrum spread system, when the output signal which flows from transmitting-side equipment to a ground through the body of a machine tool finds out being received with receiving-side

[Drawing 3] The block diagram showing the transmitter of transmitting-side equipment

[Drawing 4] The block diagram showing the receiving-side equipment of location detection equipment

[Drawing 5] The block diagram showing the transmitting-side equipment of the location detection equipment of the conventional example

[Drawing 6] The block diagram showing the receiving-side equipment of the location detection equipment of the conventional example

[Description of Notations]

1 Transmitting-Side Equipment

2 Detection Needle

3 Cell

5 Detection Signal Generator

6 Transmitter

8a, 8b Strike

9 Spring

12 Spread-Spectrum Signal Generating Circuit

14 Housing

21 Receiving-Side Equipment

22 Input Edge

24 Back-Diffusion-of-Electrons Signal Generating Circuit

## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the location detection equipment which applies a contact needle to the work piece held at the table and chuck of a machine tool, and detects the location of a work piece.

[0002]

[Description of the Prior Art] The detecting signal by contact to a detection needle and a work piece is made a RF output, it outputs to the machine tool itself, the machine tool itself is used as an antenna, a wireless electric wave is emitted, and the location detection equipment which receives with the receiver installed in an orientation and detects the location of a work piece is indicated by these people at JP,7-65883,B. Drawing 5 and drawing 6 show this location detection equipment.

[0003] Drawing 5 shows the transmitting-side equipment 1 which has a detection means and a transmitter. This transmitting-side equipment 1 is attached in the tool holder of a machine tool by the shank 7. For this reason, the shank 7 and the work piece 53 will be electrically flowed through the body of a machine tool. Three strikes 8 prepared in the case of transmitting-side equipment 1 contact the detection needle 2 by pressing with a spring 9, it is held in a predetermined stabilization location, resists the energization force of a spring 9, and is movable in three dimensions. If the tip of the detection needle 2 contacts a work piece 53, the circuit which reaches the cathode of a cell 3 through a resistor 62, the detection needle 2, a work piece 53, the body of a machine tool, and a shank 7 will be closed from the anode plate of a cell 3, and a current will flow in this circuit. This current makes the both sides of a resistor 62 produce the potential difference, and a transistor 63 flows through it according to this potential difference, and it gives a detection electrical signal to the DTMF circuit 64. This signal is changed into the duplex scale signal set up in the DTMF circuit, is given to the frequency modulation circuit 65, and the signal modulated by FM subcarrier from an oscillator circuit 66 is amplified in an amplifying circuit 13, and it is outputted. The detection needle 2 is given, it flows through a machine tool and a shank 7, the whole machine tool serves as an antenna, and this RF output emits a wireless electric wave.

[0004] Drawing 6 shows receiving-side equipment. This receiving-side equipment is installed in the orientation. It is received by the antenna 77 and the wireless electric wave emitted from the machine tool is amplified by the RF amplifying circuit 71 and the intermediate frequency amplifying circuit 74 which amplifies the intermediate frequency signal changed by the frequency changing circuit which consists of a local oscillation circuit 72 and a frequency-mixing circuit 73. Finally the amplified intermediate frequency signal is extracted as a detecting signal by the demodulator circuit 75 and the tone decoder 76, and the contact signal of the detection needle 2 and a work piece 53 is given to numerical-control equipment 32 through an interface circuitry 31.

[0005] Since according to this conventional example the machine tool itself is used as an antenna and the electrical signal by contact to the detection needle 2 and a work piece 53 is emitted as a wireless electric wave using this contact, the receiving-side equipment installed in the orientation can receive a detecting signal irrespective of migration of transmitting-side equipment. Moreover, limitation of the directivity, the magnitude, and the attaching position of an antenna is not received.

[0006]

[Problem(s) to be Solved by the Invention] With above equipment, when the high frequency current flows the closed circuit formed through a work piece and the body of a machine tool, a detecting signal is sent out as an

equipment with practical level, it is made.

[0017] In the location detection equipment of this invention, transmitting-side equipment 1 is attached in the tool holder 51 of a machine tool, and receiving-side equipment 21 is installed in the orientation contiguous to the body of a machine tool. Or it is closed. the circuit from the anode plate of a cell 3 to [ if the tip of the detection needle 2 of transmitting-side equipment contacts a work piece 53 ] cathode -- Kaisei -- The detection signal generator 5 generates a detecting signal, and modulates a detecting signal primarily by the modulation circuit 11. A series of actuation of outputting the high frequency which became irregular secondarily by the diffusion modulation technique further, and obtained this modulated detecting signal to the tool holder 51 through the housing 14 (shank 7) of transmitting-side equipment is performed.

[0018] In receiving-side equipment, the RF modulated with the above-mentioned means is inputted into the input edge 22, after a back-diffusion-of-electrons recovery is carried out by the cable connection through the cable linked to wireless or a machine tool, it gets over by the demodulator circuit 27 by the recovery method corresponding to the primary modulation technique of transmitting-side equipment, and a detecting signal is taken out by it.

[0019]

[Embodiment of the Invention] Drawing 1 shows the example of the transmitting-side equipment 1 of the location detection equipment of this invention. Transmitting-side equipment 1 has the detection needle 2, a cell 3, a switching circuit 4, the detection signal generator 5, and a transmitter 6. The transmitting-side equipment 1 whole is attached in the tool holder 51 of a machine tool by the shank 7 prepared in housing 14.

[0020] Three strikes 8a, 8b, and 8c (not shown [ 8c ]) which insulated in the housing 14 of transmitting-side equipment electrically, and were prepared in it contact the base of the detection needle 2 by pressing with a spring 9, it can be held in a predetermined quiescence stability location, can resist the energization force of a spring 9, and can move idly in three dimensions. It is equipped with the spring 9 through the electric insulator between housing or between the bases of a detection needle. As for the electrode of a cell 3, another side is connected to one side 8a of a strike for one side through the switching circuit 4 at strike 8b of another side.

[0021] If the tip of the detection needle 2 contacts a work piece 53, the detection needle 2 will carry out very small idle movement, and the ranging behavior of the base will be resisted and carried out to the energization force of a spring 9. One side of a strike separates from the base of the detection needle 2 by this, and the flow between the two poles of a cell 3 is intercepted. Thereby, a switching circuit 4 is changed into ON condition, and a transmitter 6 and the detection signal generator 5 are operated.

[0022] Drawing 2 shows the example of the detection signal generator 5. This detection signal generator 5 generates the detecting signal of a fixed electrical-potential-difference value by the partial pressure circuit from cell voltage. This electrical-potential-difference value is determined by setup of a transmitter 6. Although the bit section does not become settled in such a detecting signal, it sets up suitably.

[0023] Drawing 3 is the block diagram showing the example of a transmitter. After this transmitter 6 carries out the BPSK modulation of the detecting signal of the detection signal generator 5 in a modulation circuit 11, it multiplies the diffusion signal which is the repeat of PN sequence sign produced by the diffusion signal generating circuit 12, amplifies it in an amplifying circuit 13, and is considered as a RF output.

[0024] The RF output from a transmitter 6 is given to a shank 7, and flows to a ground through the tool holder 51 and the body of a machine tool.

[0025] Drawing 4 is the block diagram showing receiving-side equipment. This receiving-side equipment 21 has the input edge 22, the synchronous trace circuit 23, the back-diffusion-of-electrons signal generating circuit 24, the first band-pass filter 25, the second band-pass filter 26, a demodulator circuit 27, and an amplifying circuit 28. The input edge 22 is connected to the body 82 of a machine tool with the signal line 81. The RF signal inputted into the input edge 22 through the signal line 81 removes an unnecessary frequency band with the first band-pass filter 25, and is taken out as a RF input. This RF input detects the peak signal of a correlation value with PN sequence sign for the back diffusion of electrons by the synchronous trace circuit 23, it is the timing decided with the peak signal, and the back-diffusion-of-electrons signal generated by the back-diffusion-of-electrons signal generating circuit 24 is multiplied. After this RF input by which the back diffusion of electrons was carried out passes the second band-pass filter 26, a BPSK recovery is carried out by the demodulator circuit 27, and a detecting signal restores to it. After this detecting signal is amplified by required level by the amplifying circuit 28, it is given to numerical-control equipment 32 through an interface circuitry 31.

[0026] Since numerical-control equipment 32 always supervises the location of the tool holder 51 and a table 52 and is controlling this, it can know the location of a work piece 53 correctly from the position signal of the tool holder 51 when said detecting signal is given, and a table 52.

[0027] In addition, the detection signal generator 5 can also be considered as the circuitry which generates the sign of the period of fixed time amount decided by detection precision demanded. When a period is long, the configuration which adopts multiple-value phase modulation systems, such as a QPSK method, as a strange recovery method, and increases transmit data capacity can be adopted. When the signal from location detection equipment does not happen to other signals and time amount targets one after another from equipment etc., it is possible to supervise actuation of many machines, without changing the circuitry of receiving-side equipment or extending receiving-side equipment in the location detection equipment of the above-mentioned configuration.

[0028] In explanation of the example of drawing, although the example linked to the body of a machine tool with

which transmitting-side equipment was equipped with the input edge of receiving-side equipment by the cable was shown, a location detecting signal is also receivable by connecting an antenna to an input edge and receiving the electric wave emitted from the body of a machine tool.

## CLAIMS

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### [Claim(s)]

[Claim 1] The attachment section grasped by the tool shaft of a machine tool (7) Housing which it had (14), that idle movement in this housing is possible, and detection needle (2) with which were energized by the stabilization static position and it was equipped detection signal generator (5) which detects contact to a detection needle and a detected material electrically, and generates a detecting signal Transmitter which modulates and outputs this detecting signal (6) Transmitting-side equipment which it had (1) In the work-piece location detection equipment of the machine tool equipped with the receiving-side equipment (21) which is installed in an orientation, restores to said modulated signal, and is received It has a spread-spectrum signal generating circuit (12) and its back-diffusion-of-electrons signal generating circuit (24). Said transmitter (6) An output is said attachment section (7). It is work-piece location detection equipment of a machine tool which is outputted and is characterized by equipping receiving-side equipment (21) with the input edge (22) which connects the signal line linked to a receiving antenna or the body of a machine tool.

[Claim 2] Work-piece location detection equipment according to claim 1 characterized by a spread-spectrum signal generating circuit (12) modulating said detecting signal with a direct diffusion method.

[Claim 3] detection needle (2) Strike (8a, 8b) with which the stabilization static position was electrically insulated to housing (14) It turns to the strike concerned and is a detection needle (2). An energization means to energize (9) It is specified. Detection needle (2) It is a detection needle (2) by contact to a work piece (53). Very small idle movement is carried out and it is a detection needle (2). The conductive member and said strike (8a, 8b) of a end face It uses that either is isolated. Detection signal generator (5) Work-piece location detection equipment according to claim 1 or 2 characterized by generating a detecting signal.

**\* NOTICES \***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

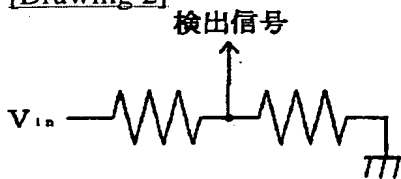
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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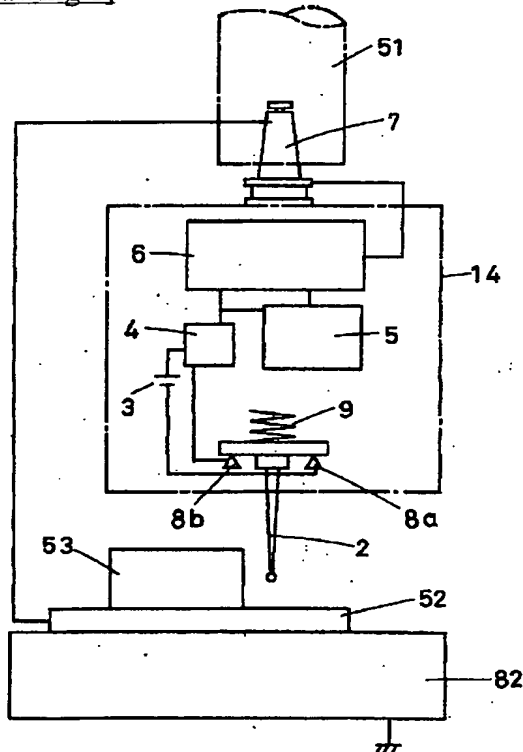
**DRAWINGS**

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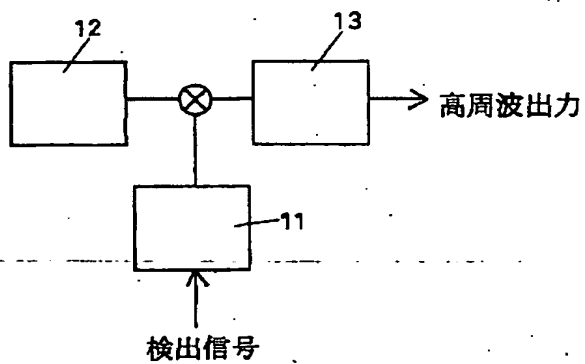
[Drawing 2]



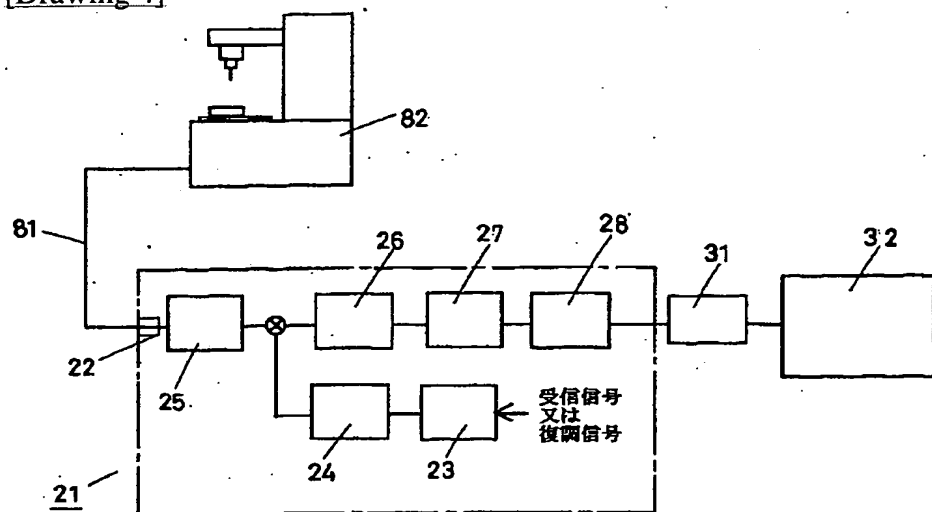
[Drawing 1]



[Drawing 3]

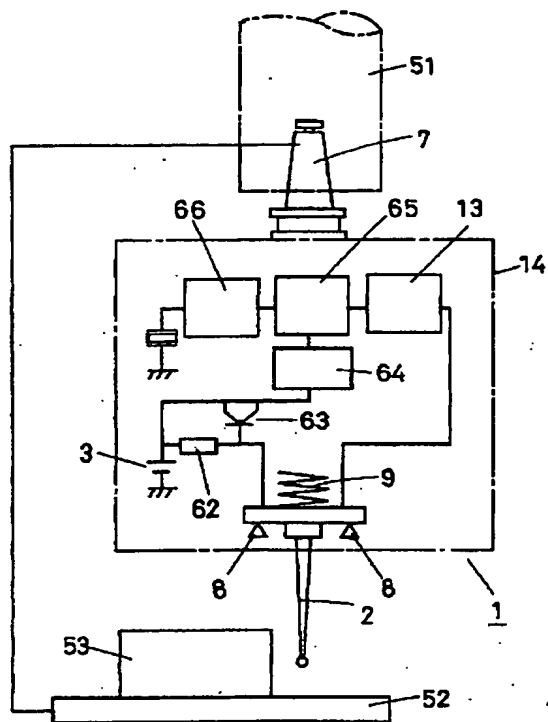


[Drawing 4]

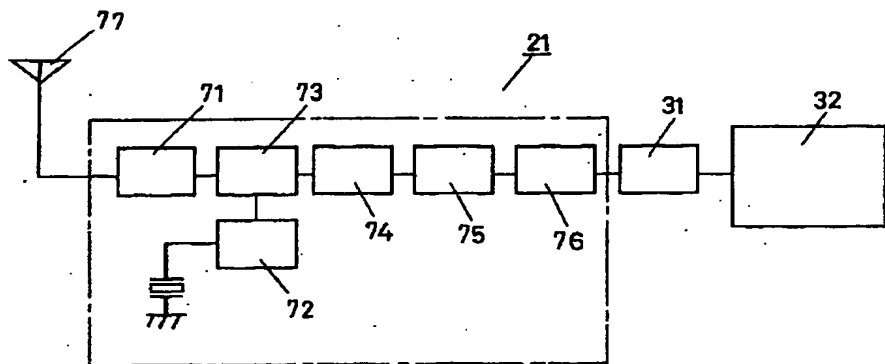


[Drawing 5]





[Drawing 6]



[Translation done.]